INTERNATIONAL
TSUNAMI
INFORMATION
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INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
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МЕЖПРАВИТЕЛЬСТВЕННАЯ ОКЕАНОГРАФИЧЕСКАЯ КОМИССИЯ

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NEWSLETTER

USA-USSR TSUNAMI MEETING

The first joint US-USSR meeting of tsunami experts to discuss the feasibility of coordinating Tsunami Warning Systems was held at the headquarters of the U. S. National Weather Service, Silver Spring, Maryland, USA, from 2 to 7 December 1974. This meeting was held under the auspices of the US-USSR agreement on Environmental Protection (May 23, 1972). The USSR delegates to the meeting were: Sergei L. Soloviev, Director, Sakhalin Complex Scientific Research Institute; Vakim M. Popov, Chief, Arctic-Antarctic Department, Hydrometeorological Service; Anatole Alekseev, Deputy Director, Computer Center, Siberian Department, Academy of Sciences; and Anatole Rykov, Research Scientist, Physics of the Earth Institute, USSR, Academy of Sciences. The USA delegates were: Bertrand J. Thompson, Chief, Oceanographic Services Branch, National Weather Service; Gaylord Miller, Director, Joint Tsunami Research Effort, Environmental Research Center; Mark Spaeth, Tsunami Specialist, Oceanographic Services Branch, National Weather Service; and George Pararas-Carayannis, Tsunami Specialist, National Weather Service Pacific Region. It was agreed at the outset of the meeting that the joint program should be developed within two basic elements: (1) Coordination of Tsunami Warning Systems; and (2) Cooperative tsunami research projects. Having reached this agreement, the participants developed plans and proposals to implement both elements in 1975 and outlined collaboration for future years.

VISITORS TO ITIC

Dr. Alexander Poplavsky, Director of the Tsunami Laboratory of Sakhalin Complex Scientific Research Center of the USSR Academy of Sciences, is presently visiting ITIC. His six-week working visit to ITIC is sponsored and funded by UNESCO's Intergovernmental Oceanographic Commission (IOC). During his stay at ITIC, Dr. Poplavsky is working on a pattern recognition study for forecasting tsunamis from seismograms.

Dr. Athelstan Spilhaus, Special Assistant to the Administrator of the National Oceanic and Atmospheric Administration (NOAA), Dr. Robert White, visited ITIC and the Honolulu Observatory on October 1974. Dr. Spilhaus was particularly impressed by the efficiency and organization of the International Tsunami Warning System and he expressed interest on the plans for its automation.

TSUNAMI WATER LEVELS AND SPECTRA FOR PERU by T. S. Murty, and S. O. Wigen.

Some tsunami water level analog records were kindly supplied to the authors by Mr. C. Vargas of the Peru Hydrographic Service. These water level records were checked for internal consistency and then were digitized. Using the Fast Fourier Transform technique, auto spectra of the water levels were calculated and plotted.

Figure 1 shows the locations of the tide gauge stations on the Coast of Peru.

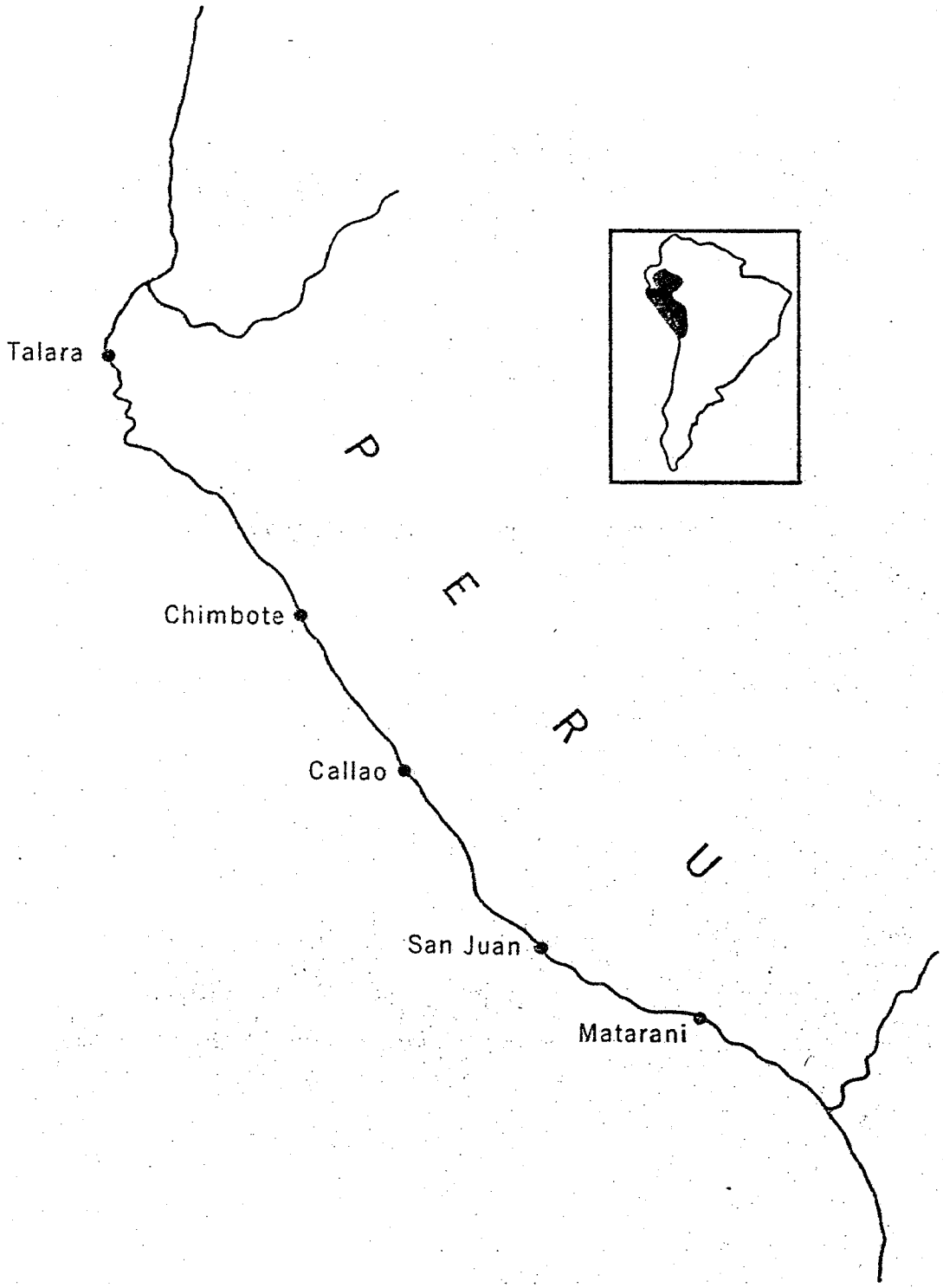
Figures 2 to 14 show the water levels at several stations for three different tsunamis, while Figures 15 to 27 show the corresponding spectra.

Table 1 lists the significant periods in the spectra; for example, for the tsunami of 17-19 October 1966, at Matarani, the period of 6 minutes is more significant than the 9.5 minute period which, in turn, is more significant than the 66 minute period.

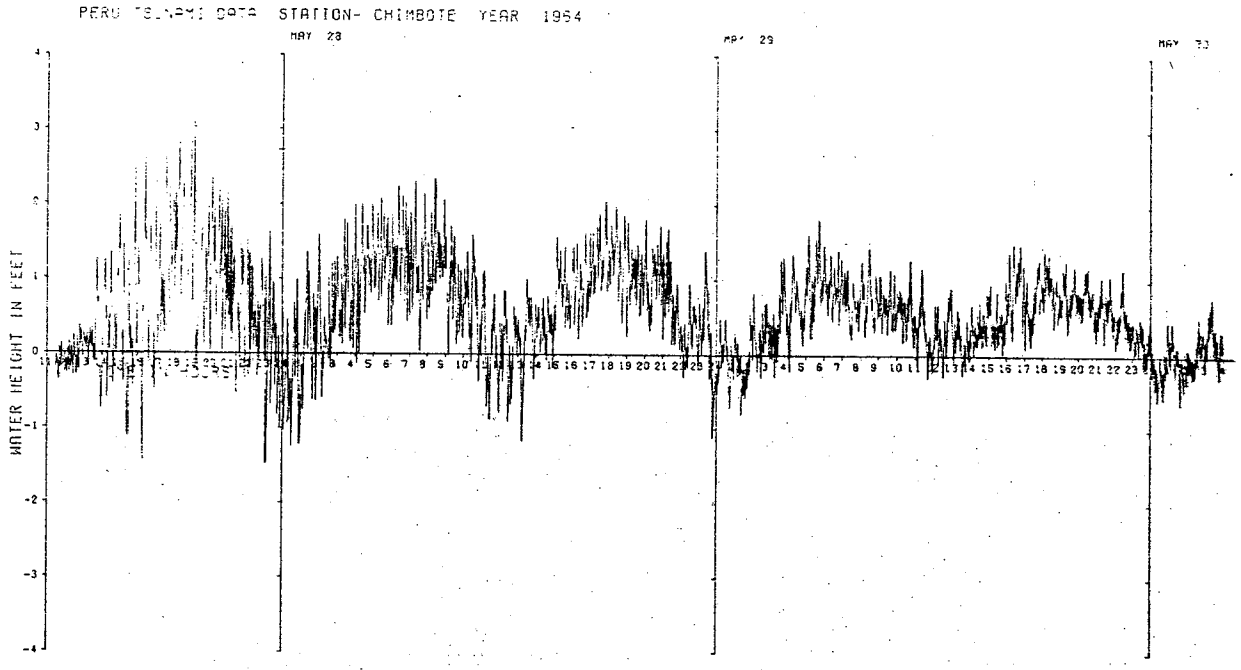
TABLE 1

Significant Periods in the Spectra of Peru Tsunamis

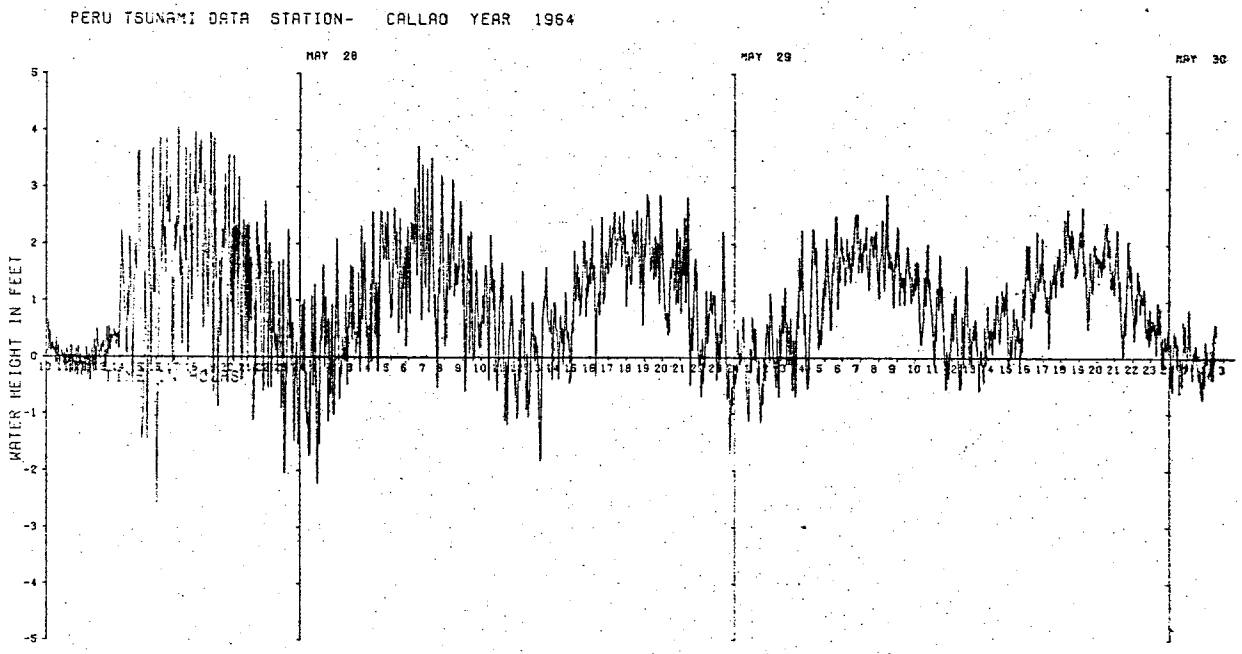
Date of Tsunami	Tide Station	Significant Periods (Minutes)
27-30 May 1964	CHIMBOTE	-
"	CALLAO	-
"	MATARANI	33
17-19 October 1966	TALARA	18
"	SAN JUAN	22, 13
"	CHIMBOTE	50, 22, 14
"	CALLAO	-
"	MATARANI	6, 9.5, 66
15-18 May 1968	TALARA	18, 10, 29
"	SAN JUAN	22, 17
"	CHIMBOTE	18
"	CALLAO	40
"	MATARANI	9.5



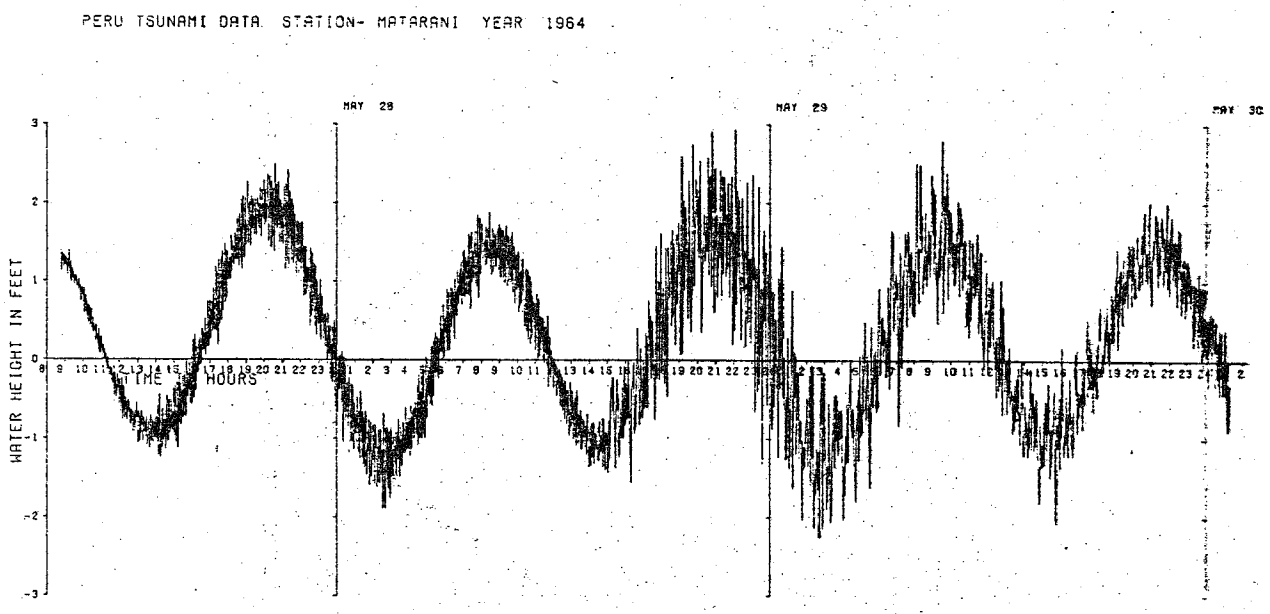
1. Tide stations on the Coast of Peru.



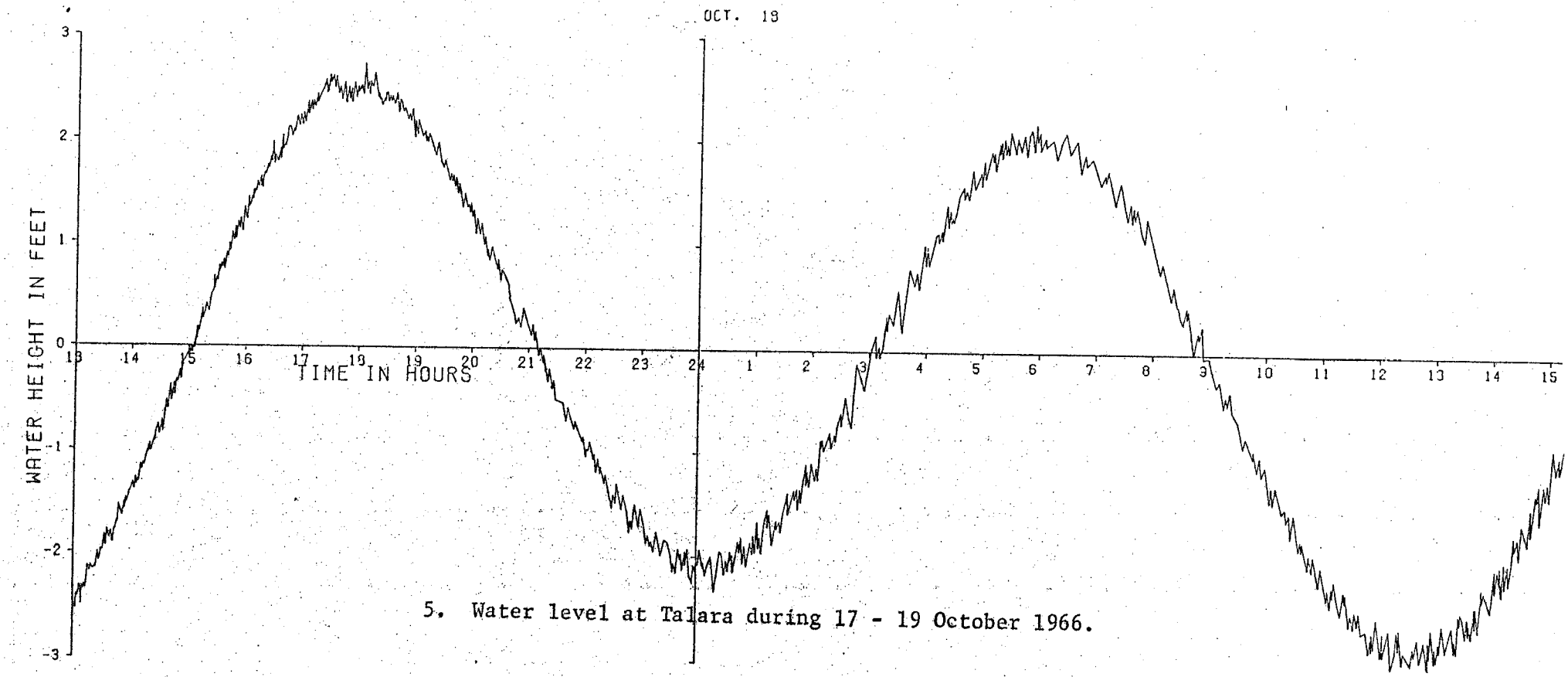
2. Water level at Chimbote during 27 - 30 May 1964.



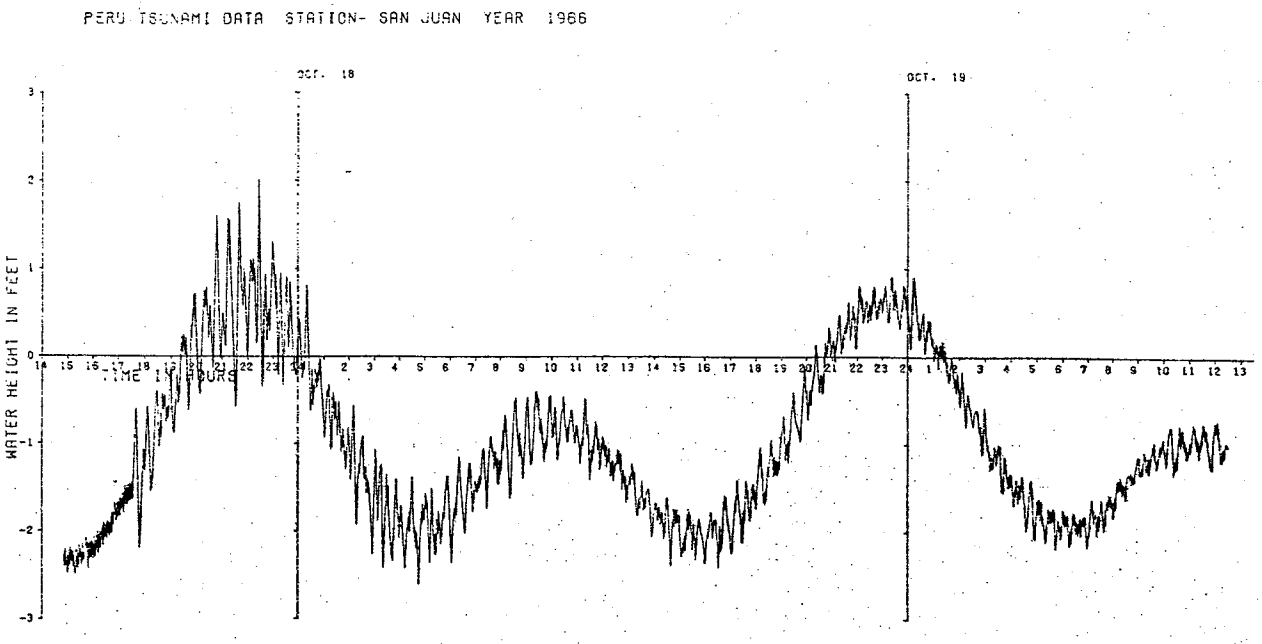
3. Water Level at Callao during 27 - 30 May 1964.



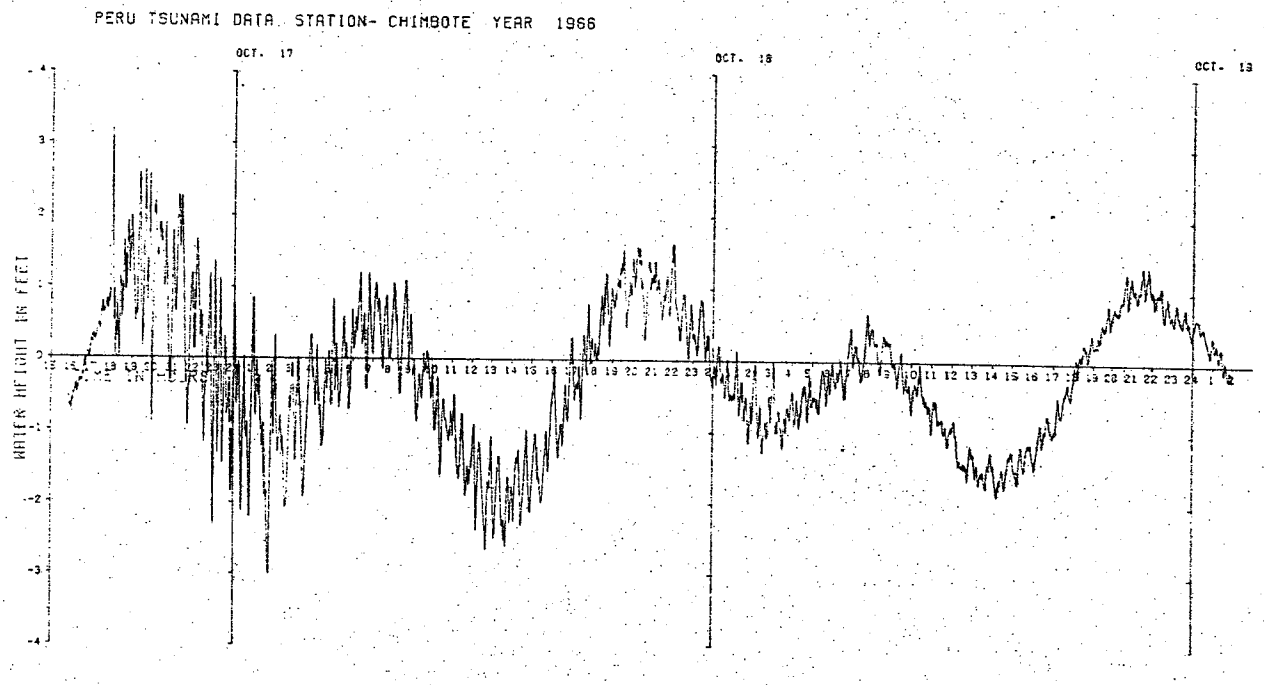
4. Water level at Matarani during 27 - 30 May 1964.



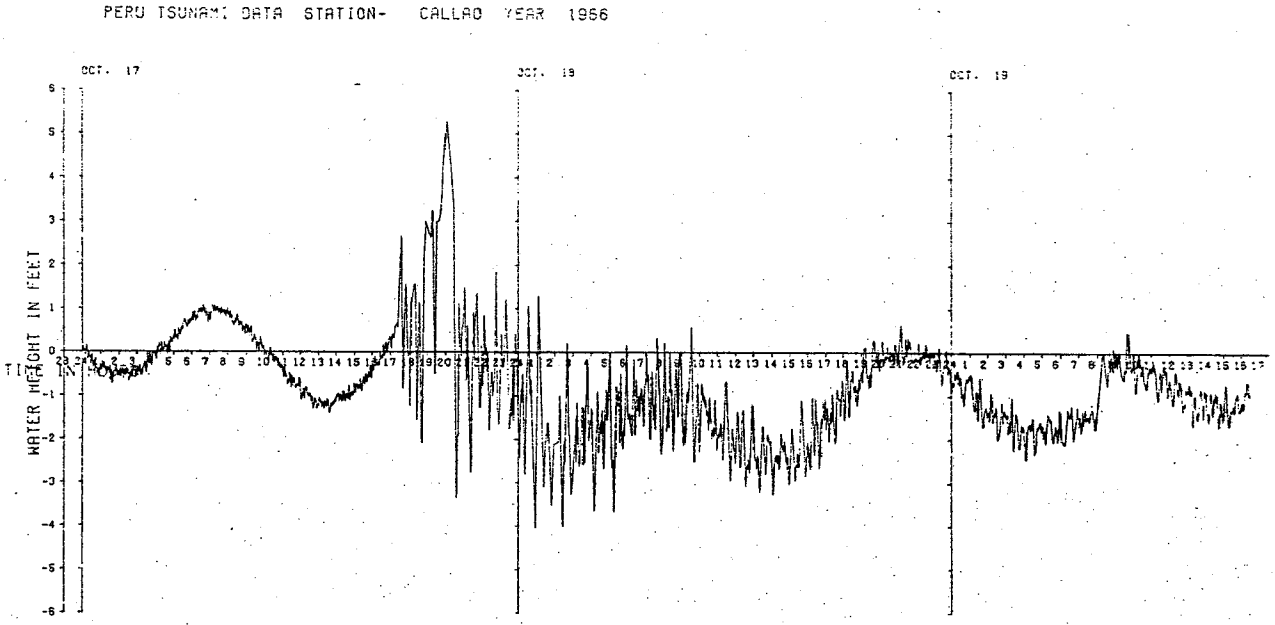
5. Water level at Talara during 17 - 19 October 1966.



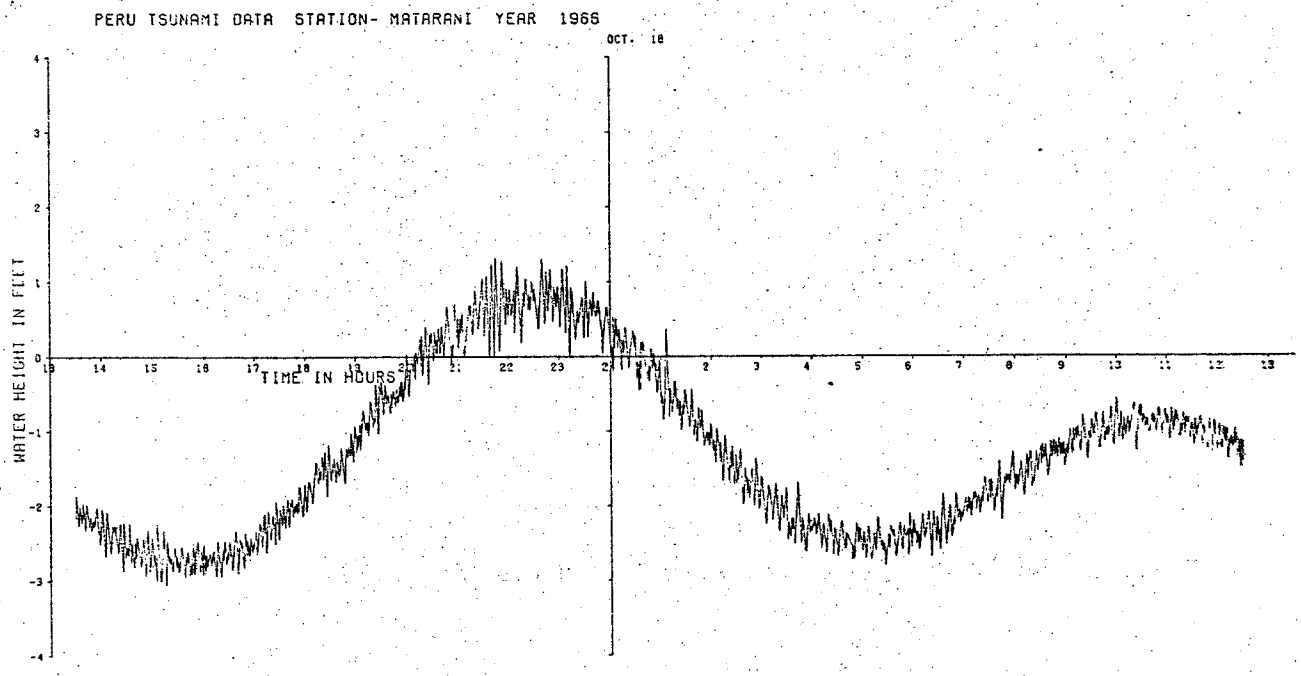
6. Water level at San Juan during 17 - 19 October 1966.



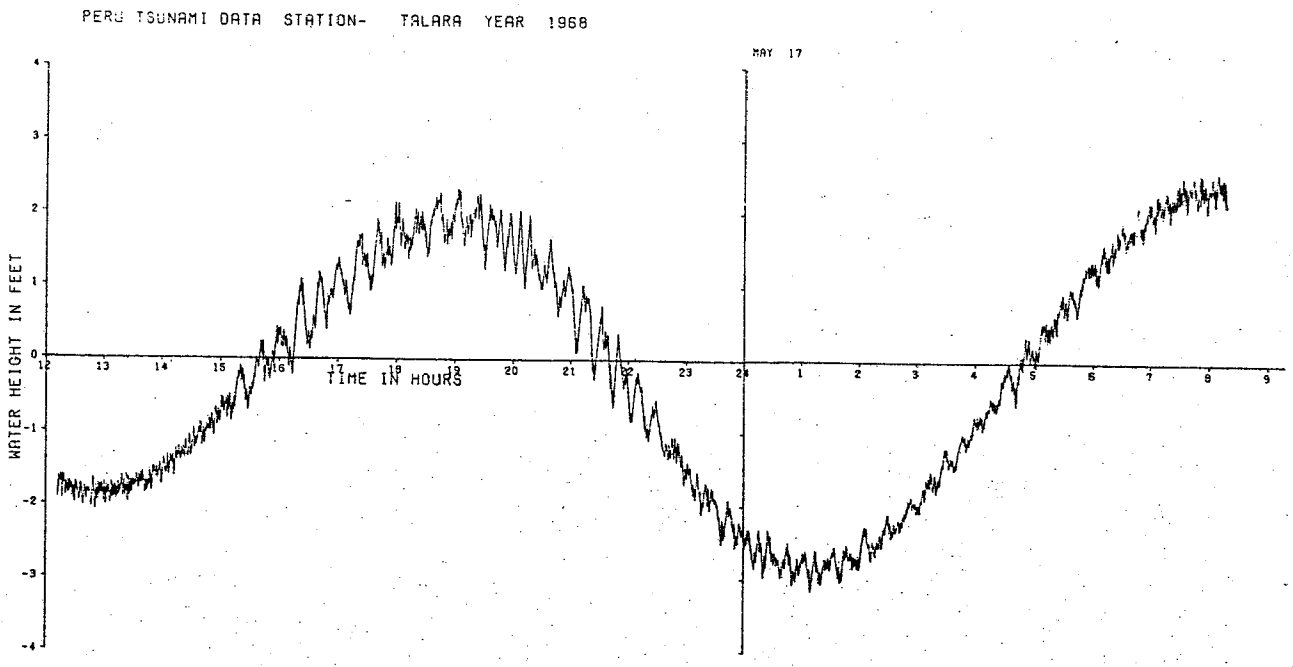
7. Water level at Chimbote during 17 - 19 October 1966.



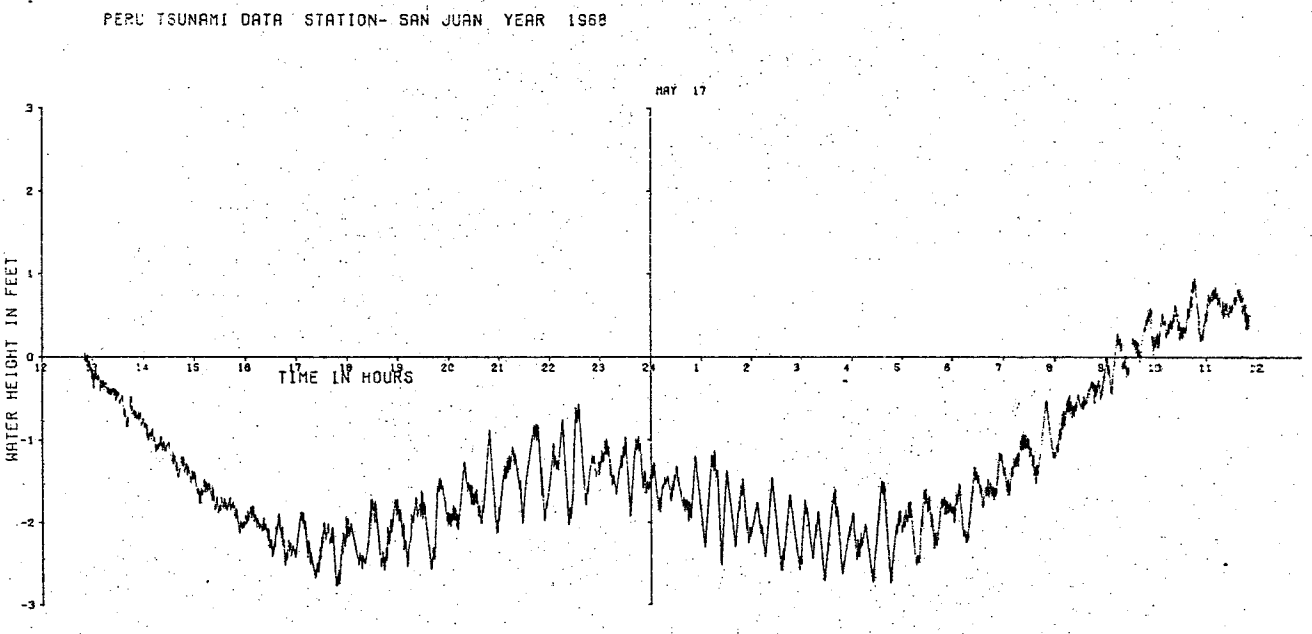
8. Water level at Callao during 17 - 19 October 1966.



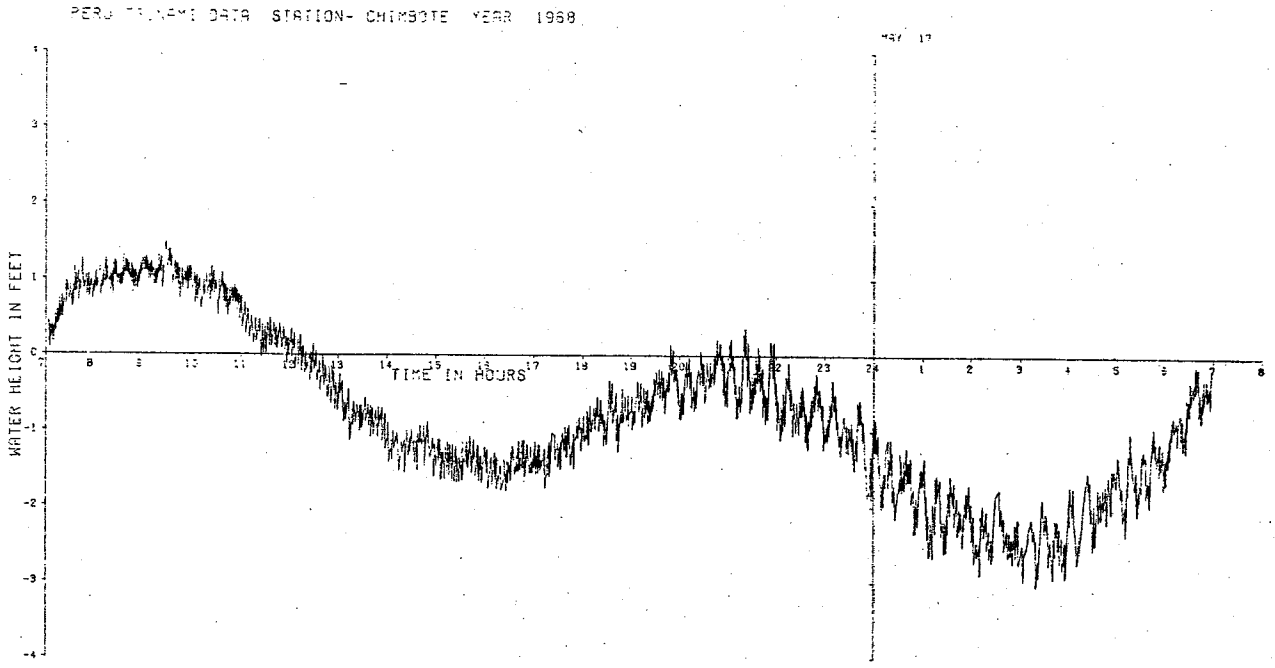
9. Water level at Matarani during 17 - 19 October 1966.



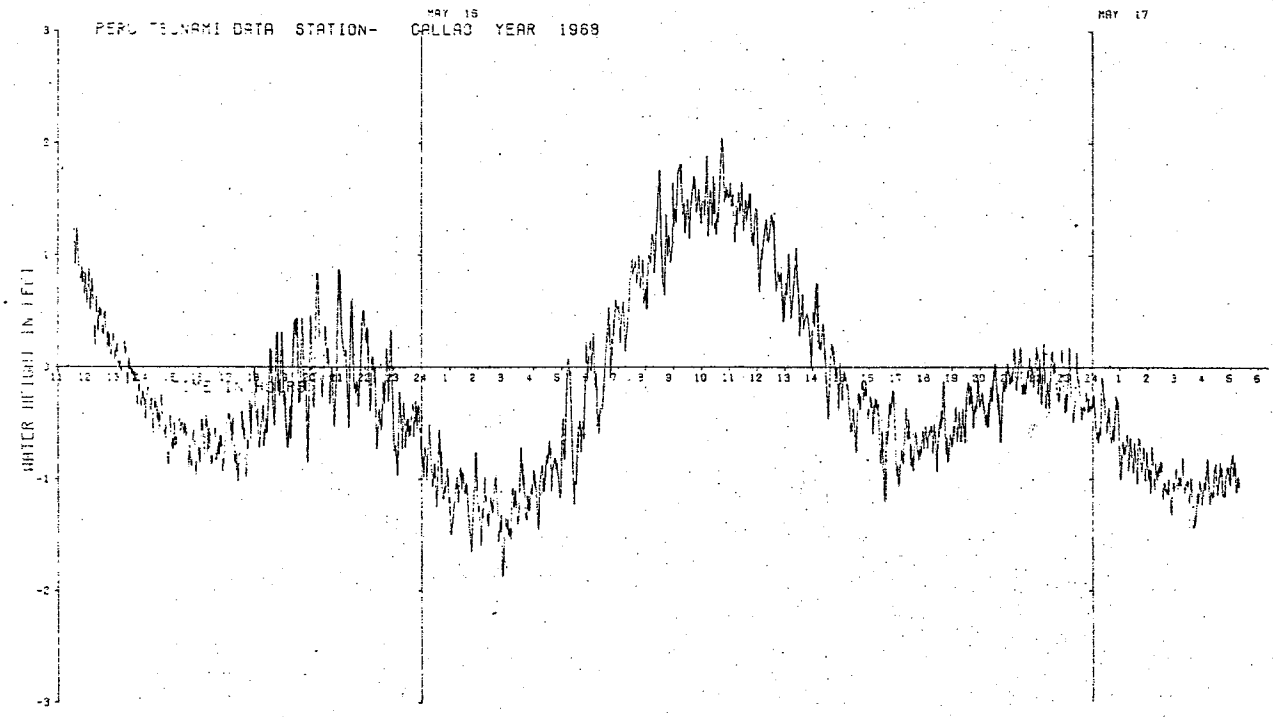
10. Water level at Talara during 15 - 18 May 1968.



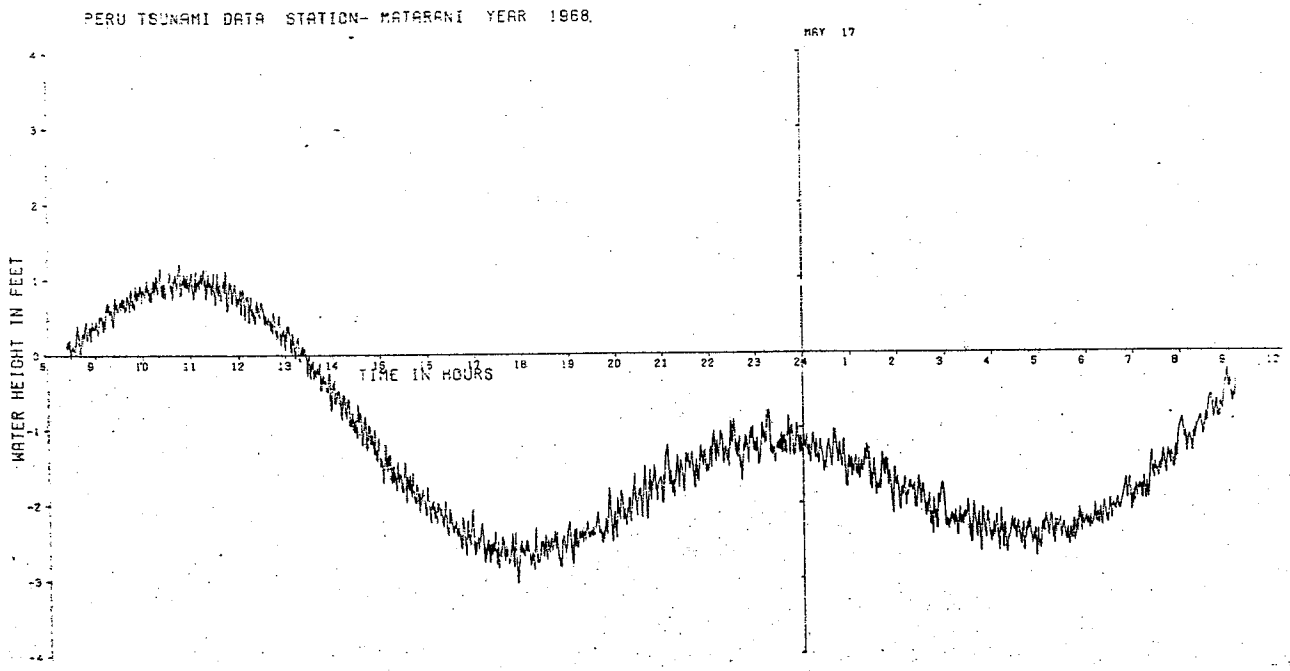
11. Water level at San Juan during 15 - 18 May 1968.



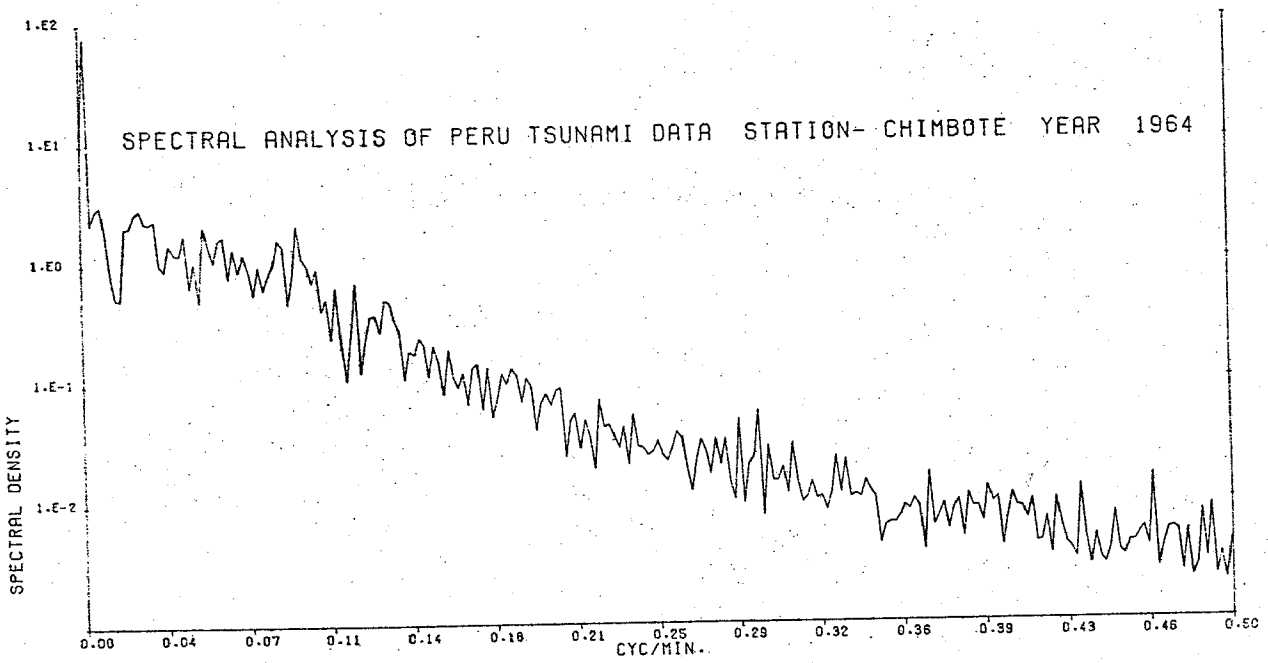
12. Water level at Chimbote during 15 - 18 May 1968.



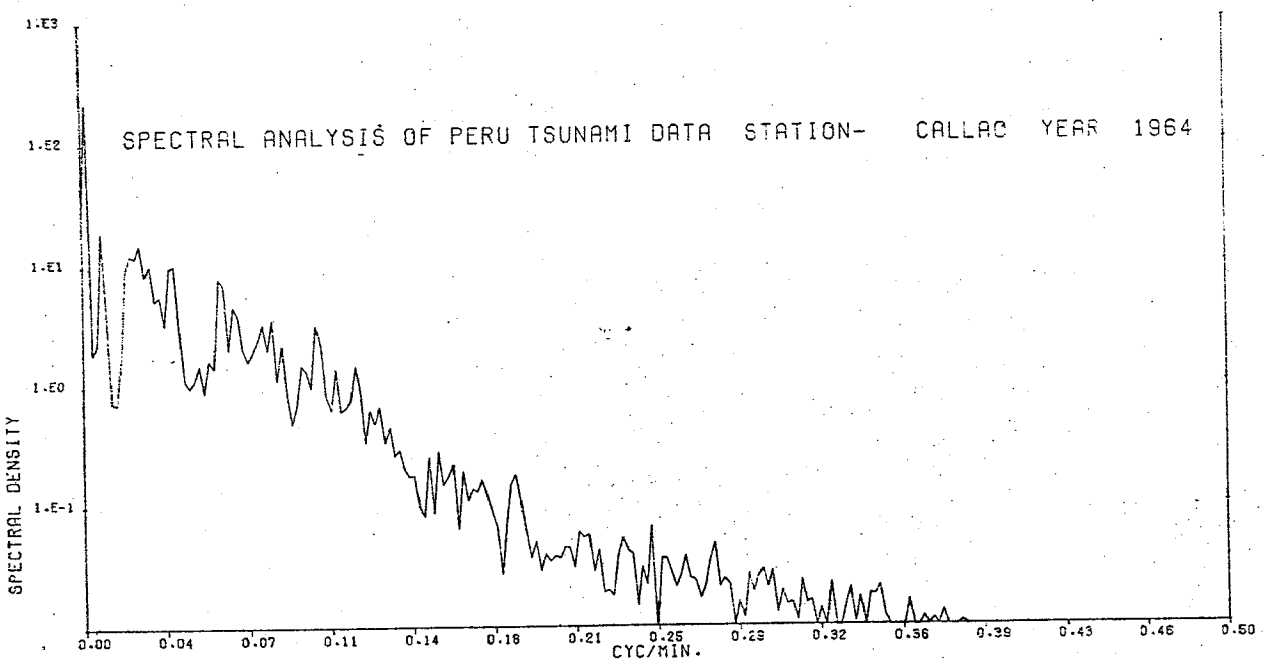
13. Water level at Callao during 15 - 18 May 1968.



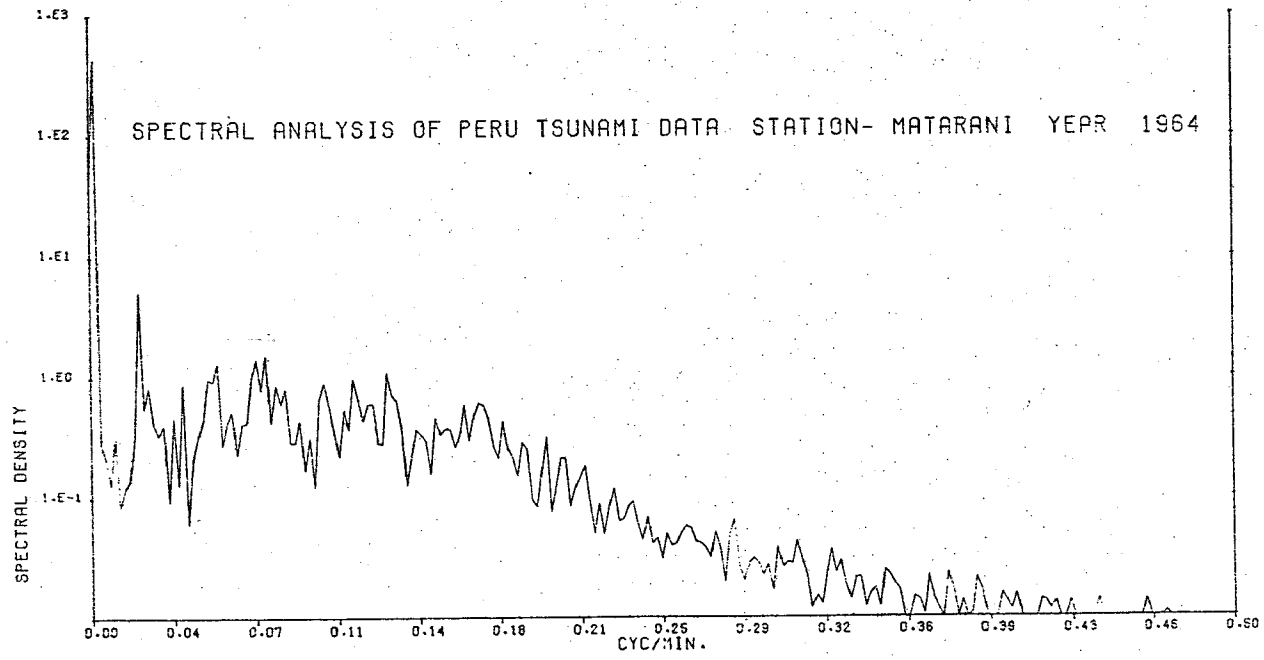
14. Water level at Matarani during 15 - 18 May 1968.



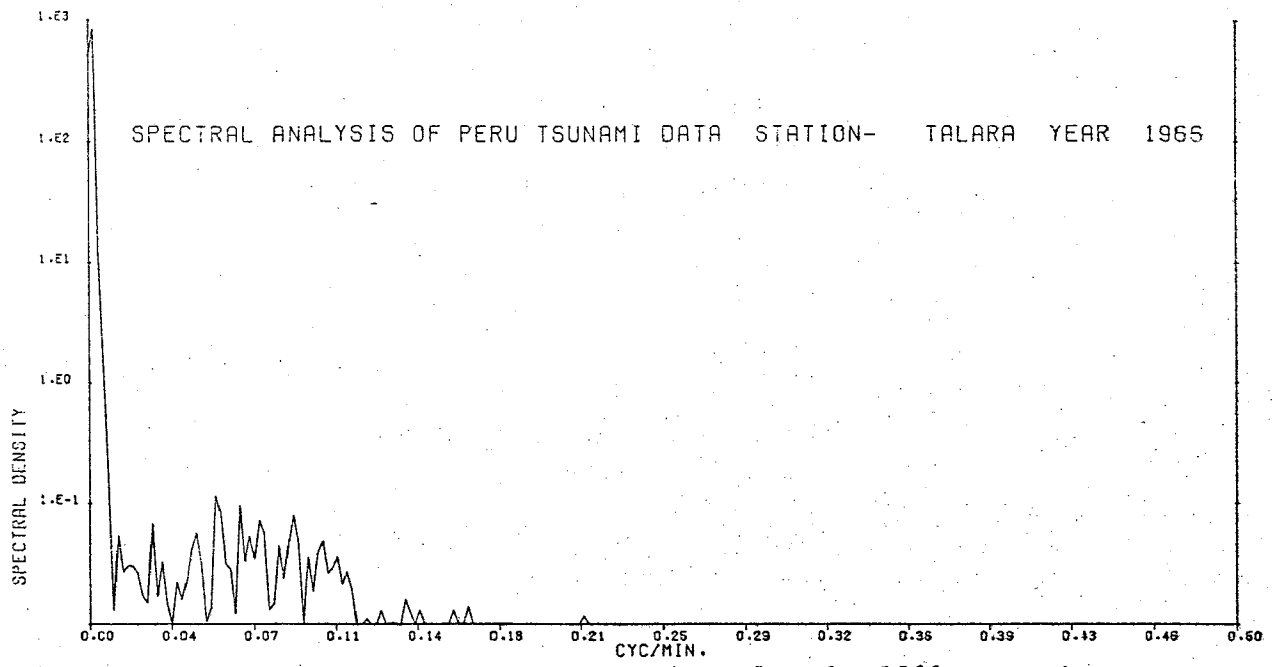
15. Spectra of the water level at Chimbote for the 1964 tsunami.



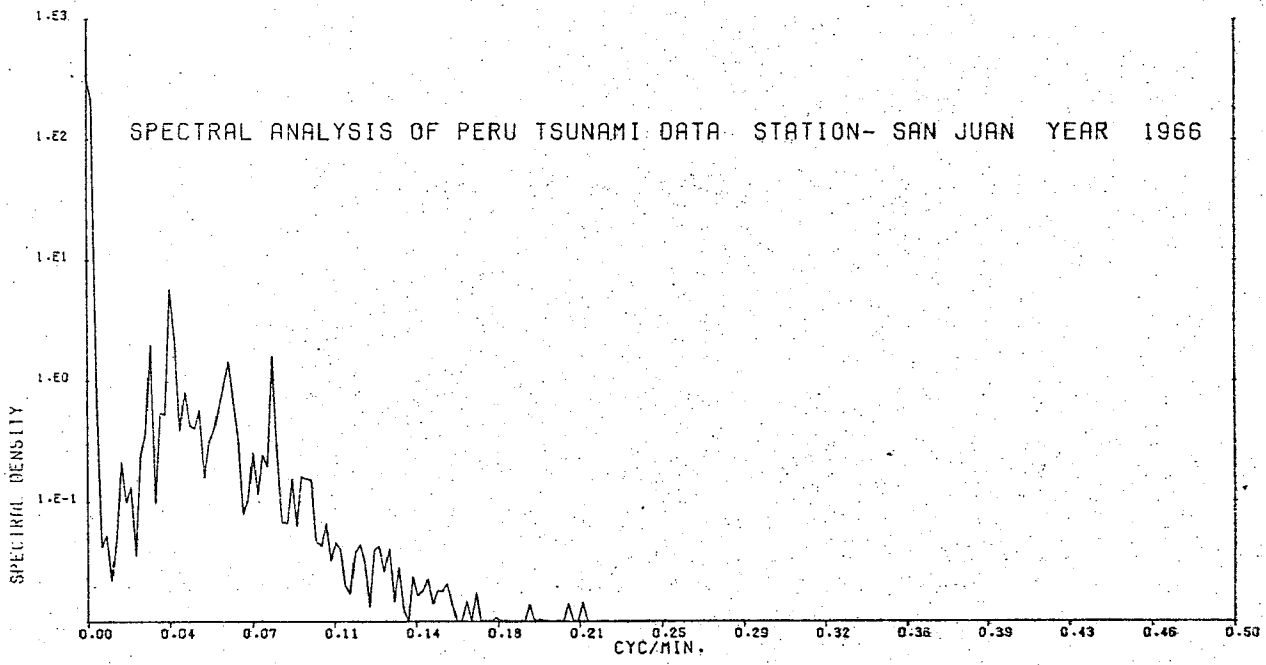
16. Spectra of the water level at Callao for the 1964 tsunami.



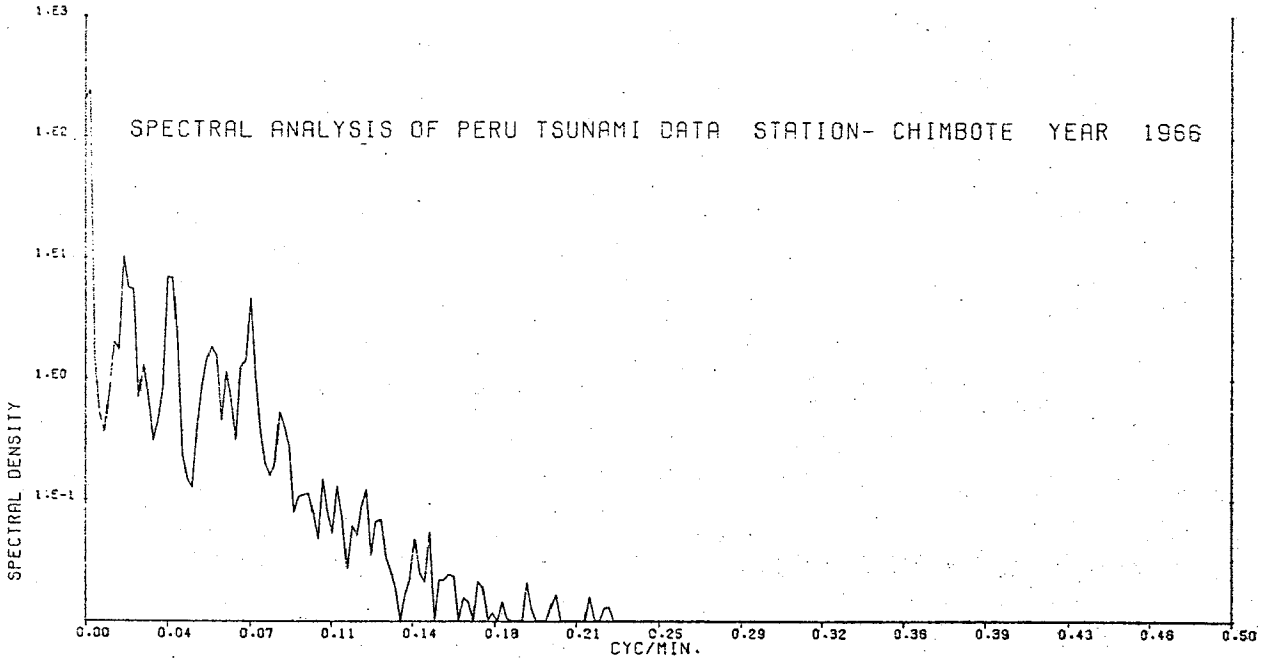
17. Spectra of the water level at Matarani for the 1964 tsunami.



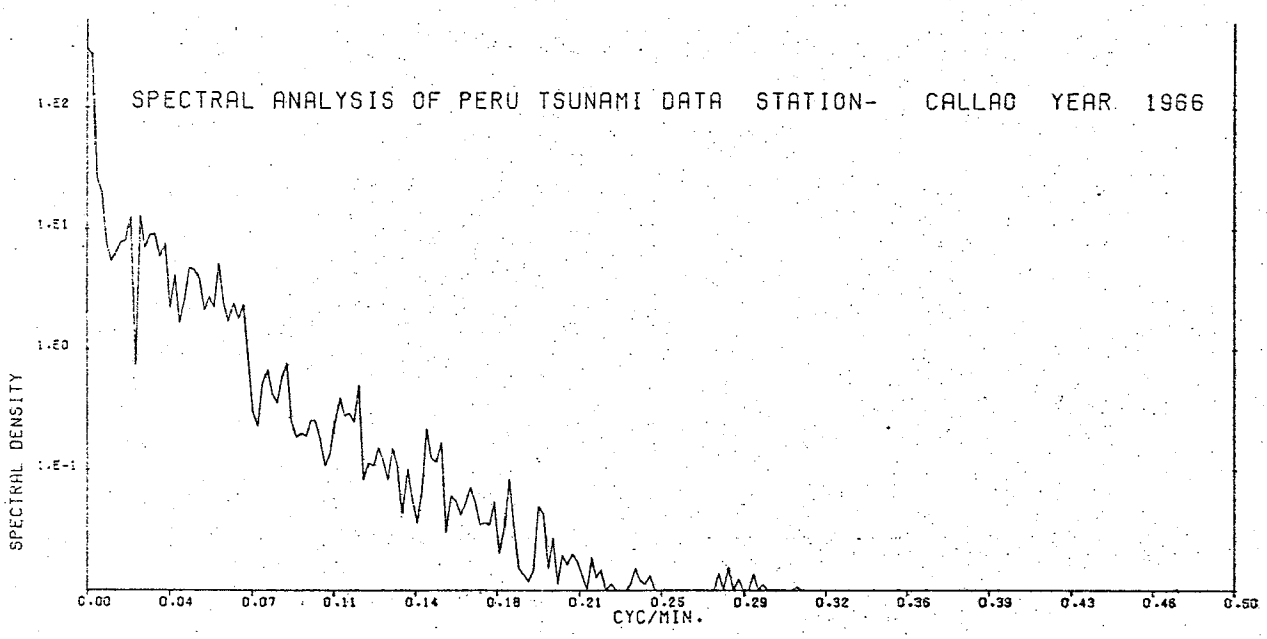
18. Spectra of the water level at Talara for the 1966 tsunami.



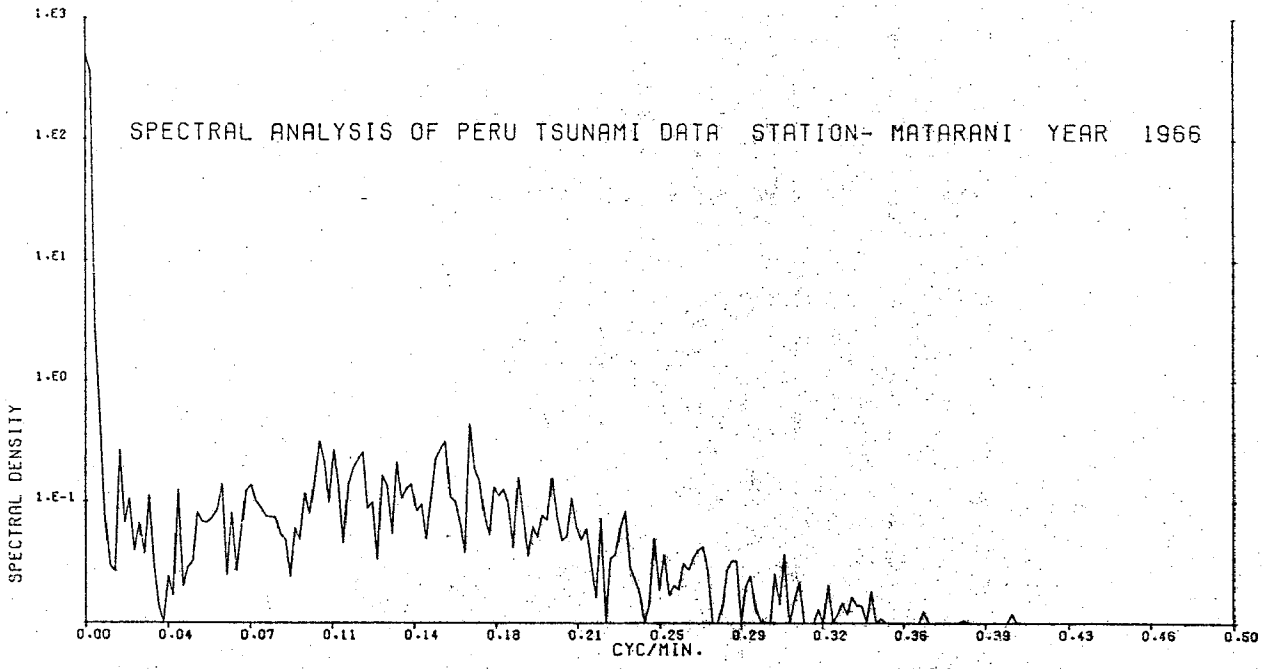
19. Spectra of the water level at San Juan for the 1966 tsunami.



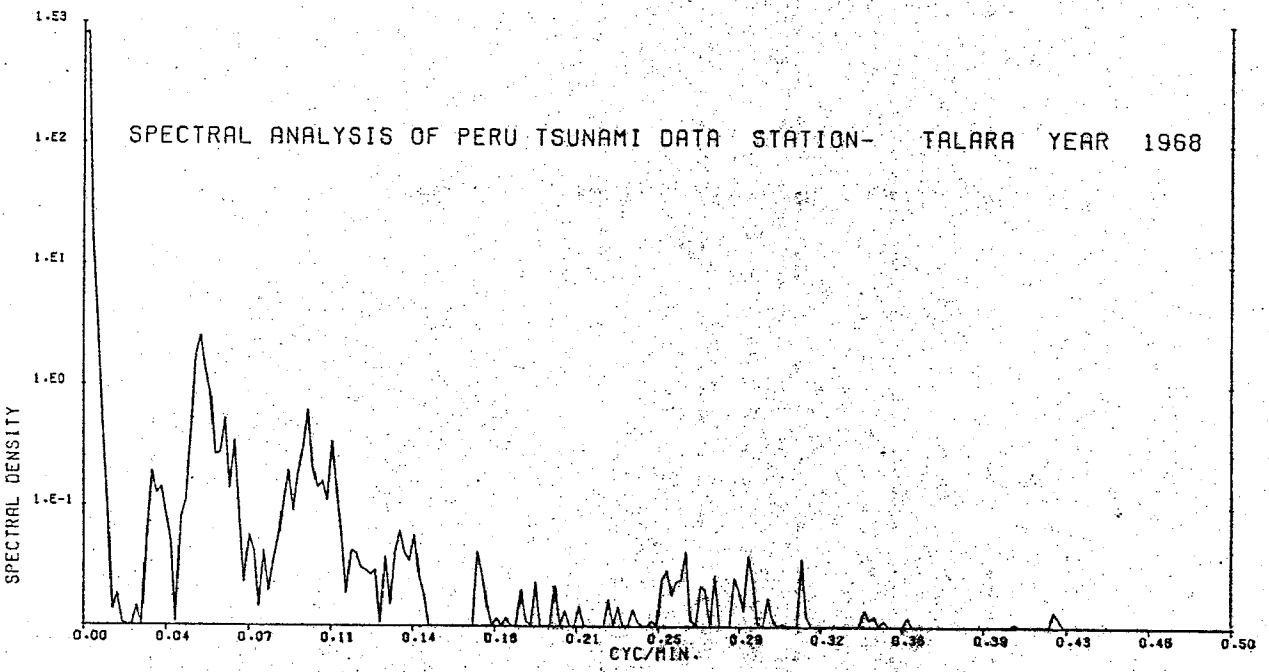
20. Spectra of the water level at Chimbote for the 1966 tsunami.



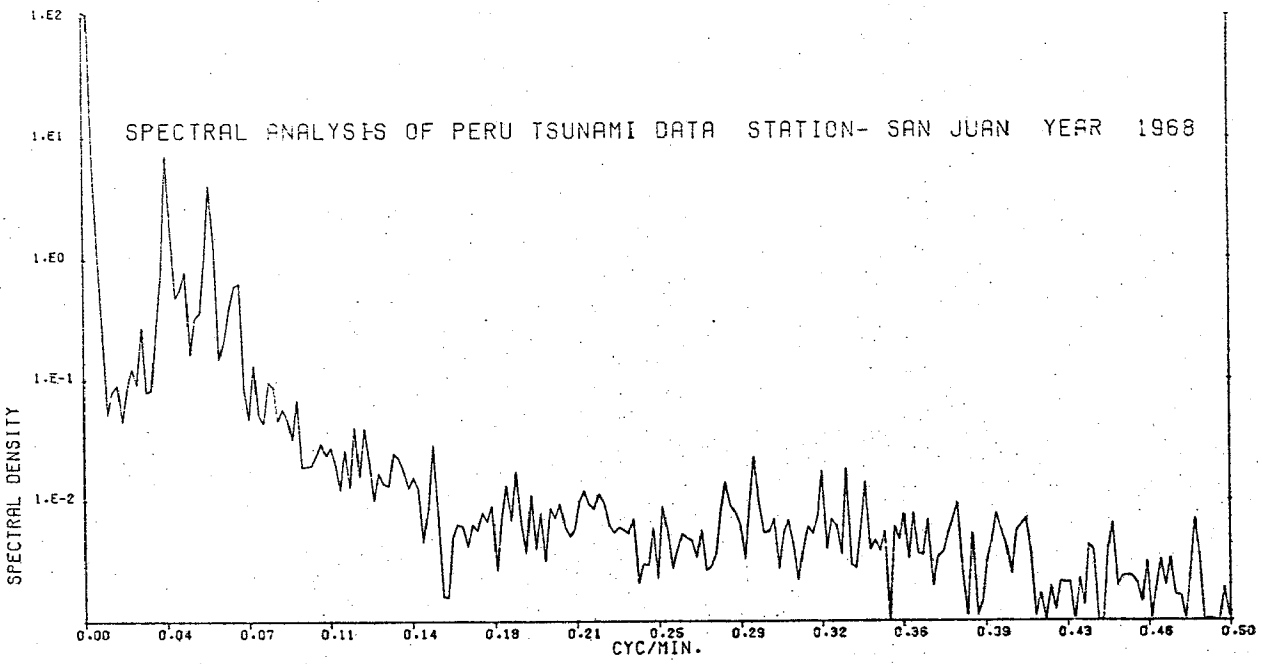
21. Spectra of the water level at Callao for the 1966 tsunami.



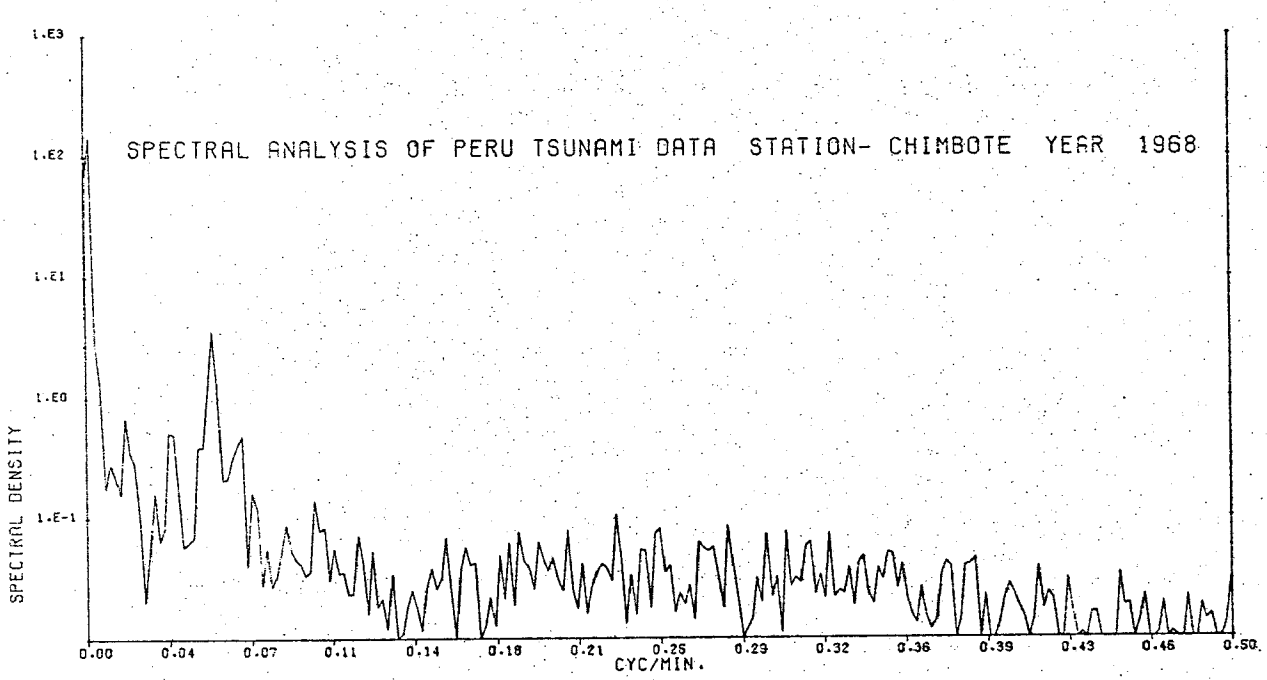
22. Spectra of the water level at Matarani for the 1966 tsunami.



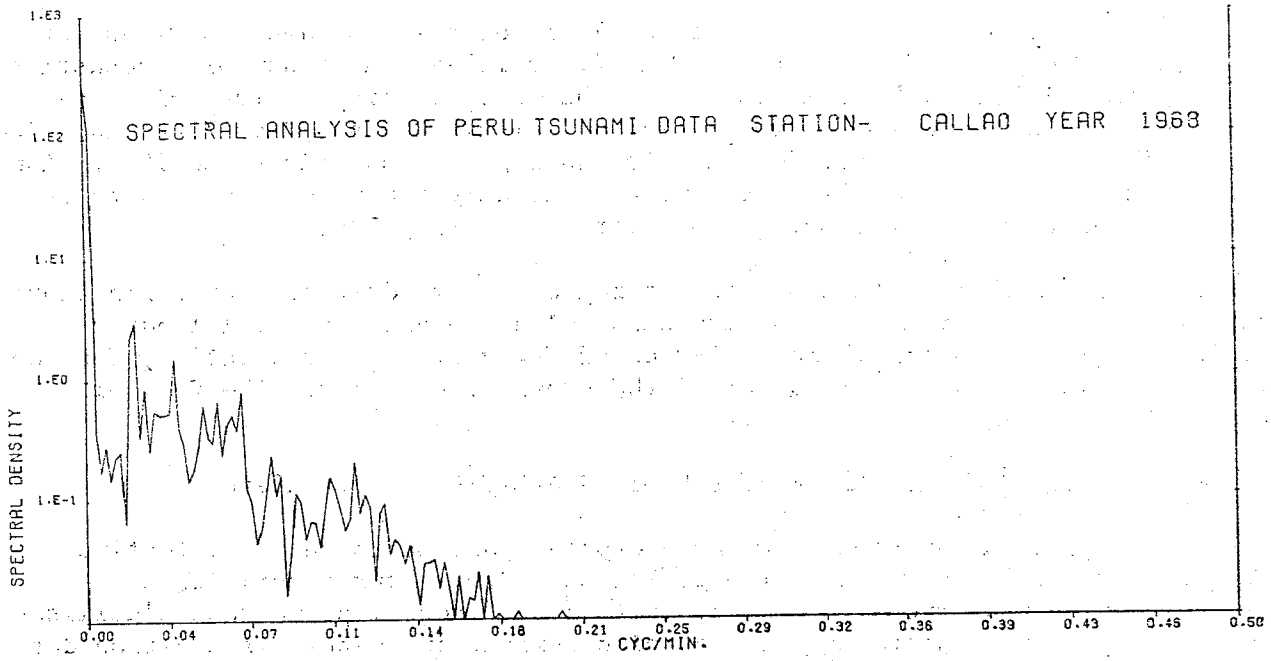
23. Spectra of the water level at Talara for the 1968 tsunami.



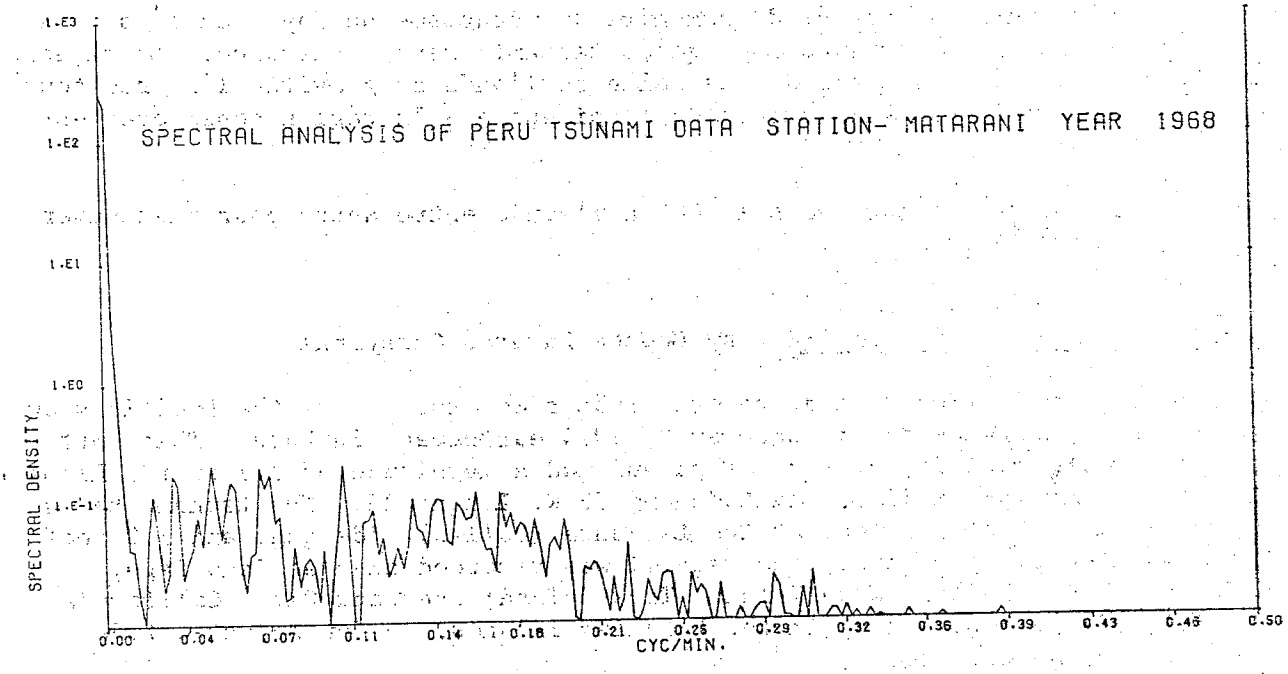
24. Spectra of the water level at San Juan for the 1968 tsunami.



25. Spectra of the water level at Chimbote for the 1968 tsunami.



26. Spectra of the water level at Callao for the 1968 tsunami.



27. Spectra of the water level at Matarani for the 1968 tsunami.

TSUNAMIS IN FRENCH POLYNESIA

The ITIC library received a copy of the doctoral dissertation of Jacques Talandier, Director of the Geophysical Laboratory in Tahiti, entitled, "A Study of Forecasting Tsunamis in French Polynesia". This is a comprehensive treatise of tsunami forecasting methods, which includes interpretation of seismic waves and of T-phases. The methods described have been in use for the forecasting of tsunamis since 1964. However, these methods in French Polynesia have been greatly improved by extending the data base with recordings from a network of stations in Rangiroa.

Dr. Talandier is currently working on the determination of additional criteria linking the generation of T-waves with that of tsunamis. The emphasis of Dr. Talandier's study is placed on correlating characteristics of T-waves, such as duration, frequency and amplitudes, with the focal mechanism of the generating events. The following is an abstract of this work:

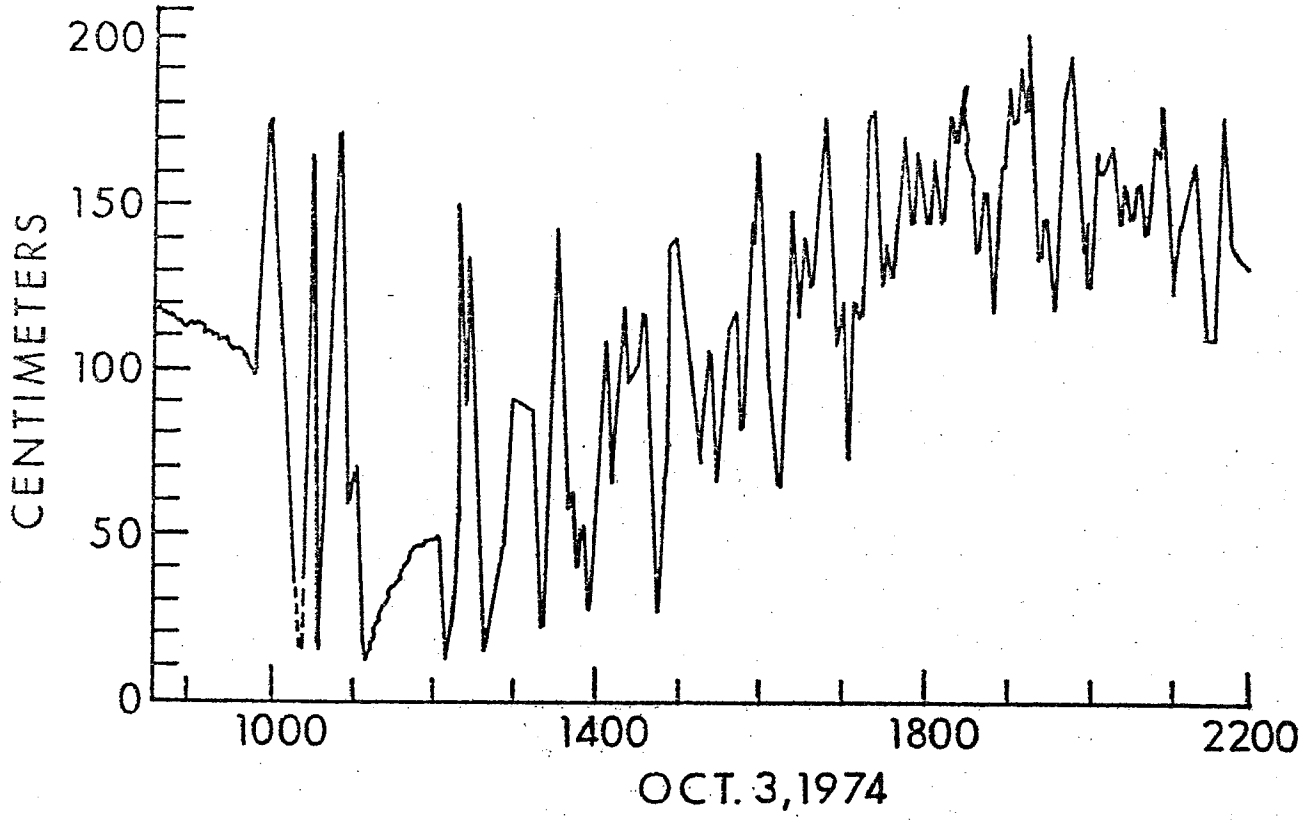
PREVISION DES TSUNAMIS EN POLYNESIE FRANCAISE by J. Talandier

La prévision des tsunamis suivant la méthode exposée dans ma thèse est effective dupuis 1964. Cette thèse date de la fin de l'année 1970. Pour bénéficier de l'experience acquise nous avons cherché un critère sur ondes T permettant l'utilisation des enregistrements existants. Il est bien évident que depuis la création des premières stations sismologiques en 1962, la quantité et la qualité des mesures ont évolué favorablement. En particulier les enregistrements à grande dynamique sur bande magnétique de toutes les informations du réseau nous permettent des études plus poussées des signaux recus et la recherche de critères complémentaires sur les ondes T et P. Toutefois le principe reste le même : estimation de l'énergie dissipée dans l'ocean à partir des caractéristiques des ondes T. Une forte libération d'énergie dans l'océan produit simultanément une onde de gravité, le tsunami et des ondes de compression, les ondes T à génération abyssale que l'on peut assimiler à l'onde de choc. Les caractéristiques de ces ondes T et en particulier, leur durée, directement liée à la longueur de rupture de faille ou à la surface d'ébranlement des fonds marins permet ainsi par une étude sommaire du mécanisme au foyer du séisme de dire si les conditions sont remplies pour qu'un tsunami prenne naissance. La vitesse de l'onde T étant beaucoup plus grande que celle de l'onde de gravité, l'alerte peut être donnée en temps utile si la distance de l'épicentre á la région considérée est supérieure à 2.000km.

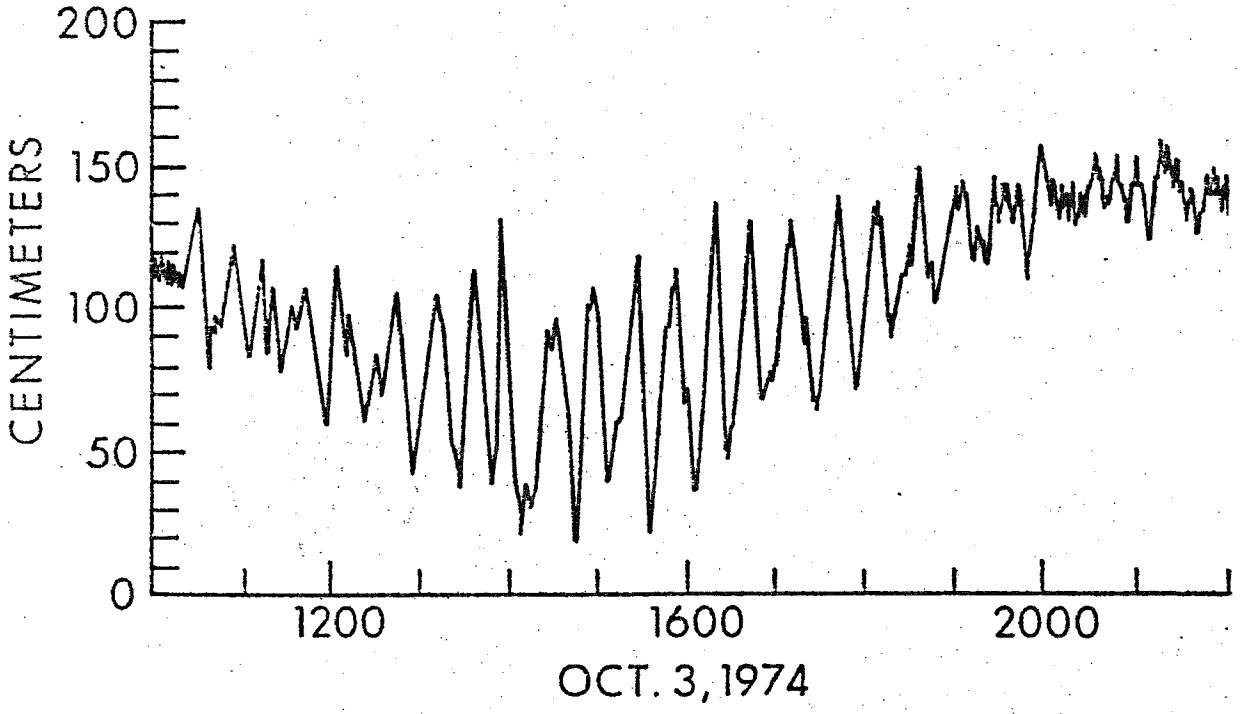
Des critères complémentaires sur ondes T sont à l'étude entre autre pour distinguer les divers types de génération.

THE TSUNAMI OF OCTOBER 3, 1974 IN PERU by George Pararas-Carayannis

Recent preliminary evaluation of tide records from tide stations in the Pacific show that a tsunami was generated by the October 3, 1974 earthquake in Peru. This earthquake occurred in the vicinity of Lima, Peru and had a magnitude of 7.7 on the Richter scale. Its epicenter was at 12 S. Latitude and 76 W. Longitude. The tsunami had a range (trough to crest) of 5.2 feet at the La Punta (Callao) tide gage and 3.8 feet at the San Juan tide gage, in Peru. The tsunami was recorded also at Pago Pago, American Samoa; Midway Island; Wake Island; Truk Island; Crescent City, California; and at Kahului, Hilo, and Honolulu, in the Hawaiian Islands. A few selected tide gage recordings are shown here.



ig.1. Tide Gage Record Showing the Tsunami of October 3, 1974, at La Punta, Callao, Peru.



Tide Gage Record Showing the Tsunami of October 3, 1974, at San Juan, Peru.

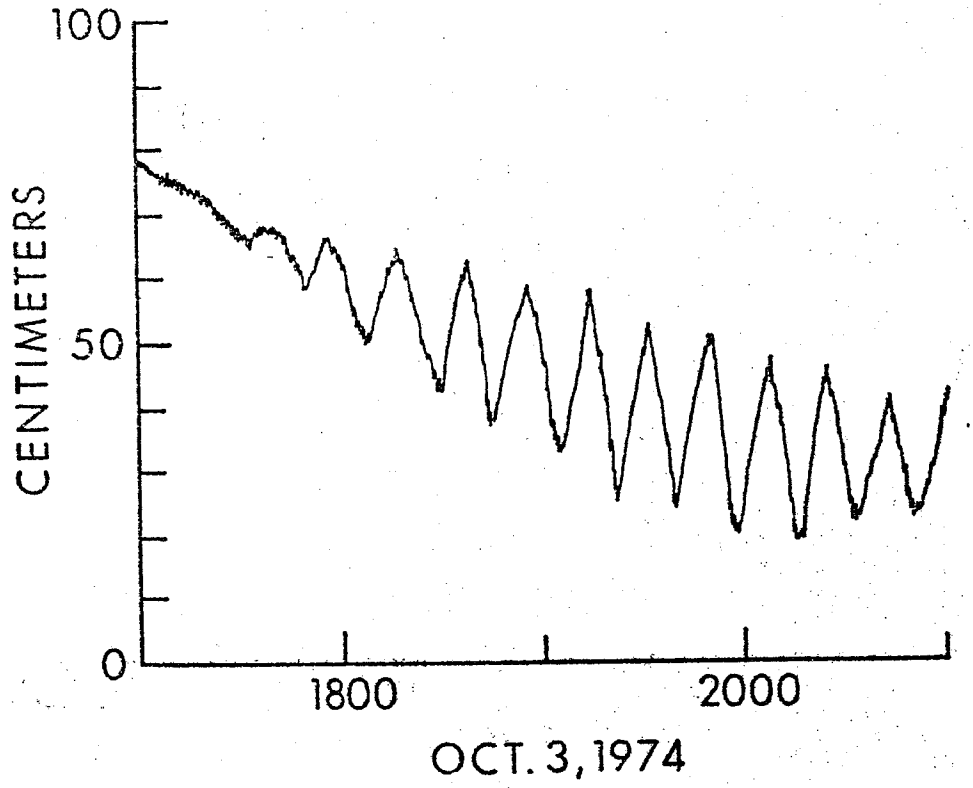


Fig.3. Tide Gage Record Showing the Tsunami of October 3, 1974 at Pago Pago, Am. Samoa.

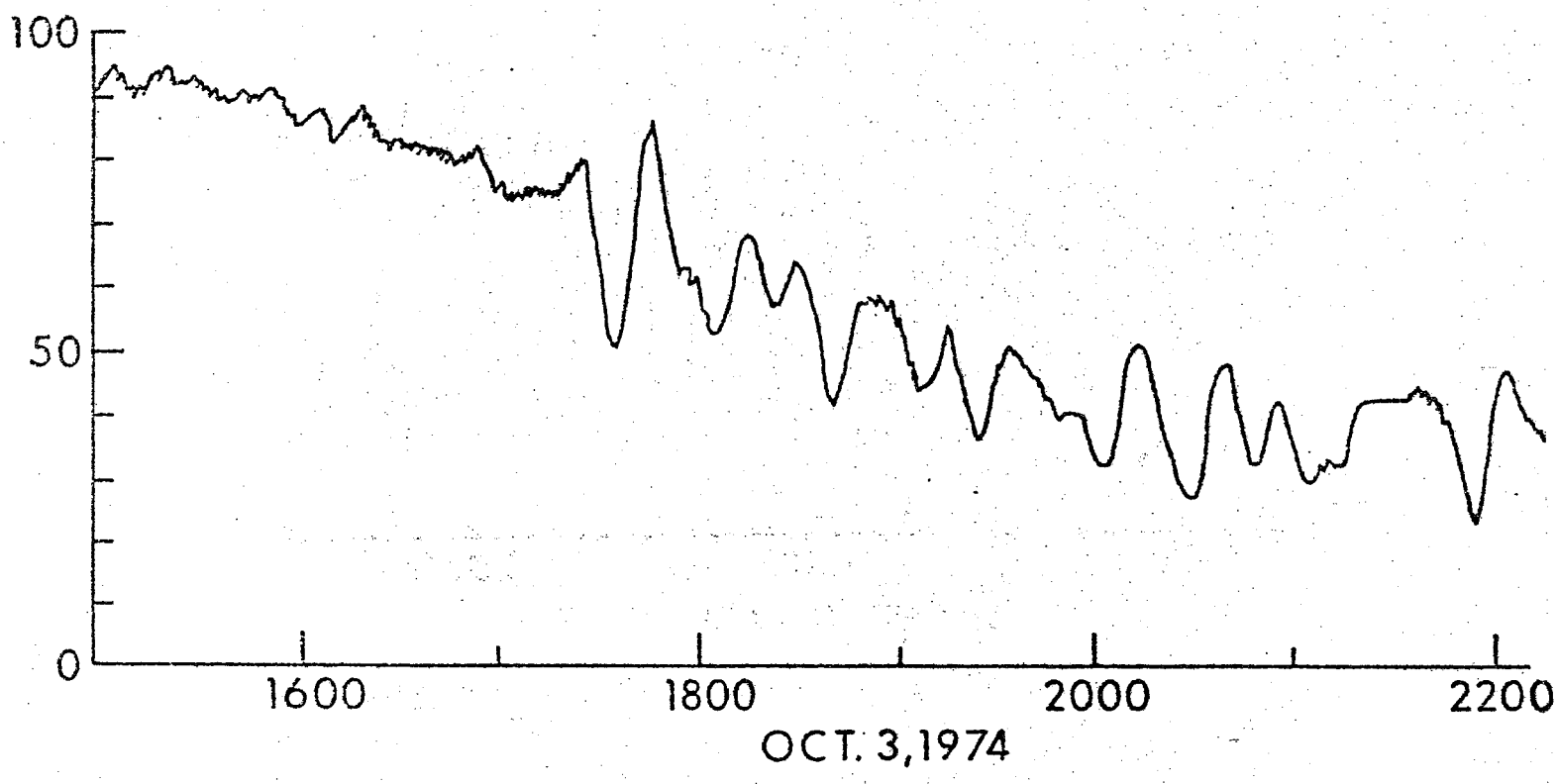


Fig. 4. Tide Gage Record Showing the Tsunami of October 3, 1974 at Kahului, Hawaiian Islands.

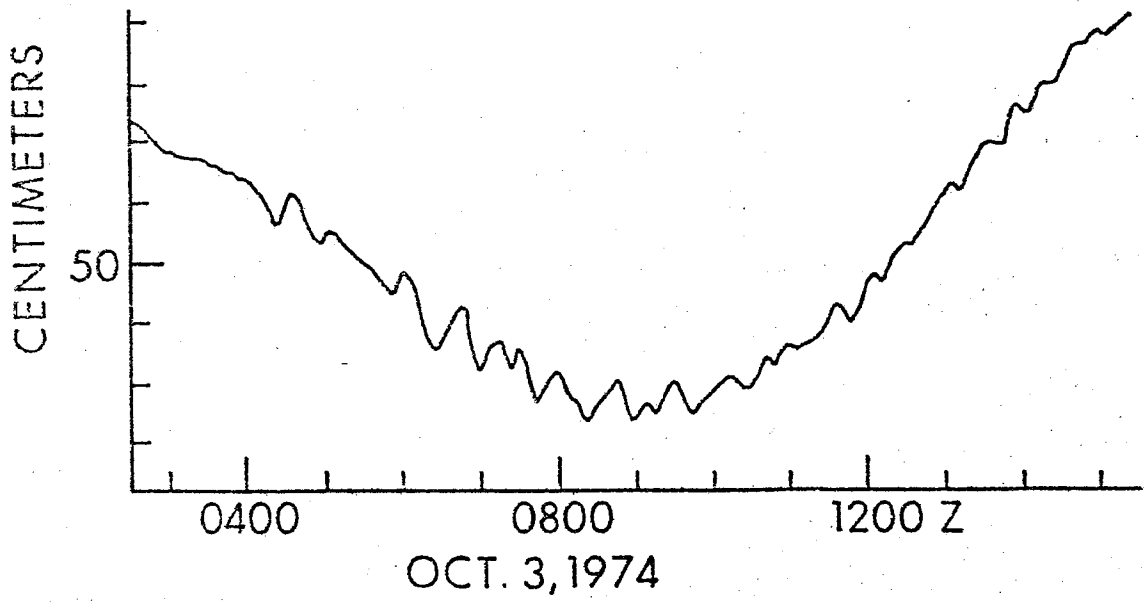


Fig. 5. Tide Gage Record Showing the Tsunami of October 3, 1974 at Hilo, Hawaiian Islands.

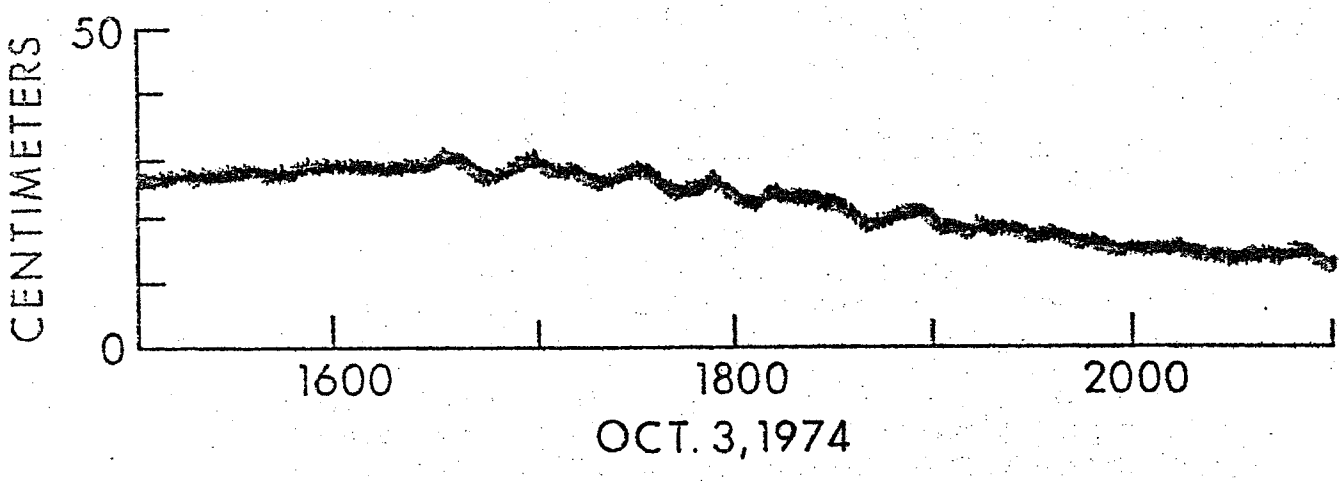


Fig. 6. Tide Gage Record Showing the Tsunami of October 3, 1974 at Honolulu, Harbor, Hawaiian Islands

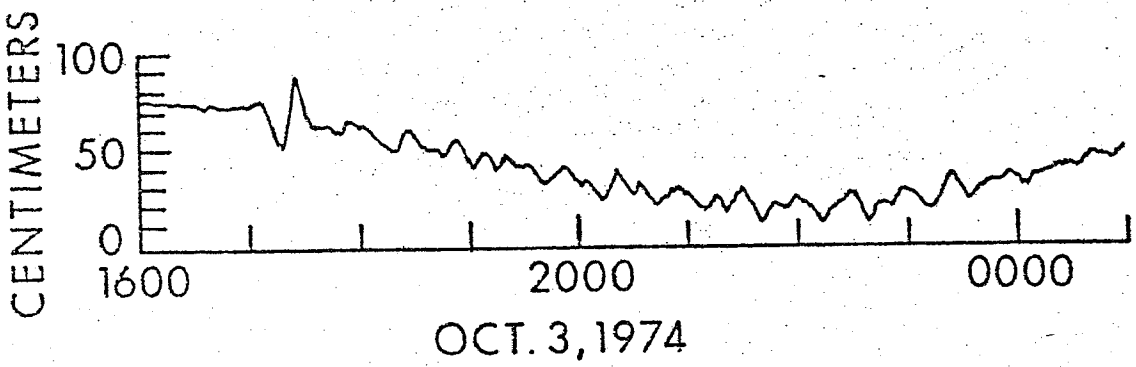


Fig. 7. Tide Gage Record Showing the Tsunami of Oct. 3, 1974, at Hawaii Kai, Honolulu, Hawaiian Islands.

MR. MONTANER CONCLUDES WORKING VISIT AT ITIC

Mr. Ricardo Montaner, Chief of the Division of Tides and Currents of the Hydrographic Institute of the Chilean Navy and responsible for the operations of the National Tsunami Warning System in Chile, who visited and worked at the International Tsunami Information Center (ITIC), left this month for Valparaiso, Chile. Mr. Montaner's visit to ITIC was sponsored and funded by UNESCO's Intergovernmental Oceanographic Commission (IOC).

During his stay at ITIC, Mr. Montaner became familiar with the operations of Honolulu Observatory, which is the nerve center of the International Tsunami Warning System, and discussed with ITIC personnel methods for improving the real-time exchange of seismic and tidal data from stations in Chile. While at ITIC, Mr. Montaner received assistance in preparing a draft proposal which will be submitted to the United Nations Development Program (UNDP) by the Government of Chile requesting funds for the improvement of its warning system. Improvements of the Chilean Warning System will make the International Tsunami Warning System more efficient in disseminating warnings for tsunamis generated in South America.

Also Mr. Montaner worked with personnel of ITIC and the Joint Tsunami Research Effort (JTRE) on a computer method for the quick determination of earthquake epicenters in Chile, and on a study of resonance responses of selected Chilean harbors to tsunami waves.

PROPOSED EXPERIMENT BY THE JOINT TSUNAMI RESEARCH EFFORT AT THE STRAIT OF MAGELLAN
by Gaylord R. Miller

One of the experimental programs at the Joint Tsunami Research Effort is a study of the large-scale water motions which can be deduced from electric field measurements in the ocean. This program is conducted by Dr. Jim Larsen and several interesting results related to large-scale water motions have already been achieved. For example, tidal currents in the vicinity of the Hawaiian Islands have been measured on a broad average basis and an analysis made which permits the construction of co-tidal and co-range charts for an area centered on the Hawaiian Islands. This broad average extends out to a radius of perhaps 500 to 700 kilometers.

An application of what is basically the same technique in the region of the Strait of Magellan in Chile is seen as a way of producing both good background data for analysis and perhaps a prototype of an operational system for predicting the currents within the Strait of Magellan. During his visit here, Mr. Ricardo Montaner indicated that a problem exists as the very large tankers must go through the Strait on their way from the major oil fields of the world to the distribution points. Very high water velocities occur, both tidal currents and steady flow, but superimposed upon these are considerable variations due to changes in the mean current flows and due to atmospheric conditions which made a real time forecast of water motion essential for supertankers. The problem of maintaining a conventional current meter in the middle of a strait where the currents may exceed 6 knots if formidable. However, these same very high water currents induce large electric field in the seawater. Seawater being a conductor moves through the geomagnetic field and induces these electric fields. These fields are easily measurable with instrumentation systems developed by Dr. Larsen and Dr. Robert R. Harvey.

Dr. Harvey of the Hawaii Institute of Geophysics and Mr. Montaner of Chile will make the test installation in cooperation with the Chilean Navy. Basically, electrodes are placed into the seawater and the induced variable electric field of several millivolts per kilometer will be recorded. This can then be correlated with the observed currents. We have every reason to believe that the system will prove effective. The Strait of Magellan is at a geomagnetically low latitude. Thus problems of noise from ionospheric or auroral signals will be minimized. Water velocities are very high; therefore the induced electric fields are very high and thus easily measurable.

The entire project is an interesting outgrowth of Mr. Montaner's visit to ITIC. While it is unrelated to tsunamis per se, it does point to the added value of these international exchanges not only for their original specific purpose of improving tsunami warnings in the Tsunami Warning System and advancing tsunami research but also other related fields in oceanography and geophysics.

IUGG-IAPSO TSUNAMI MEETING

In addition to the regular IUGG-IAPSO meeting in Grenoble, France, announced previously, the session on tsunamis has been confirmed. The tsunami meetings will be held on Friday afternoon, 29 August 1975. Applications for participation and abstracts should be submitted by 1st February 1975 to Prof. S. L. Soloviev, Sakhalin Complex Scientific Research Institute of the Academy of Sciences of the U.S.S.R., Novoalexandrovsk, Sakhalin, 694050, U.S.S.R. The abstracts should be not more than one page in length and written in English or French.

Additional opportunity to deliver a paper on tsunamis is offered by Prof. B. F. Savarensky, convener of the large symposium "Geological-Geophysical Phenomena Predicting Accompanying and Following Earthquakes." Those who wish to present papers in this session should also send their abstracts to the above mentioned address in order to have them printed in the Conference program.

HONOLULU OBSERVATORY

Computer automation is proceeding as scheduled with emphasis on the communications part of the Tsunami Warning System. The original computer terminal, located at HO, was replaced in December 1974. This recent equipment includes a CRT data display terminal, a data communications printer and a cassette data tape which permits data storage and retrieval on magnetic tape.

The same commercial time-share computer facility, located approximately 25 miles from HO, is currently being used. Simultaneously, however, a military facility time-share computer is also in use to determine the most applicable facility to meet the Tsunami Warning System requirements.

TSUNAMI INVESTIGATIONS--AUGUST-SEPTEMBER 1974 (Correction)

On page 12, under the headline "Tsunami Investigations--August-September 1974" and referring to the date and origin time of an earthquake occurring in southern Chile, August 20 was indicated as the date of this event. The correct date of occurrence of this earthquake is August 18.

2ND ANNUAL SYMPOSIUM ON MODELING TECHNIQUES

The 2nd Annual Symposium on Modeling Techniques for Waterways, Harbors, and Coastal Engineering will be held at Hyatt on Union Square, San Francisco, California, September 3-5, 1975.

The objective of the Symposium is to provide a forum in which the state-of-the-art of various types of models can be discussed and to provide a mechanism by which not only the relative merits of mathematical and physical models can be reviewed but also, and more fundamentally, the applicability of models to specific problems can be evaluated.

Additional information for this meeting can be obtained by writing to:

MODELING 75, Civil Engineering Department
Clemson University
Clemson, South Carolina 29631, U.S.A.

TSUNAMI INVESTIGATIONS -- September-December 1974

The International Tsunami Information Center's Honolulu Observatory investigated several large earthquakes during the period of September-December 1974. Only the earthquake of October 3, 1974 in Peru generated a small tsunami which was recorded in Peru and in several other Pacific stations. No Pacific-wide tsunami was generated by the other earthquakes.

Date and Origin Time (U.T.)	Epicenter	Depth	Magnitude	Region	Comments
September 27 05-47-07	41.7N 144.5E		6.8	Hokkaido, Japan	
October 3 14-21-23	11.5S 77 W		7.7	Lima, Peru	Watch called 25 cm Hilo
October 8 09-51-16	18.4N 62.8W		7.2	Leeward Is. Caribbean	
October 23 06-14-57	6 S 155 E		7.0	Solomon Is. area	
November 9 13-00-08	9 S 73 W		7.2	Peru	
November 20 04-14-36	16 S 167 E		7.2	New Hebrides	
December 1 13-54-23	19.3N 155.3W		5 - 5.5	5-10 miles SW Is. of Hawaii	Kilauea
December 16 09-17-29			4.5	Is. of Hawaii	
December 25 17-47-49	19.21S 155.17W		4.5	S Side Kilauea Is. of Hawaii	
December 31 22-41-			5 - 5.5	Is. of Hawaii	